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Predictability of the Annual Vegetation Cycles over Sahel from AVHRR-NDVI data: a preliminary nonlinear space-time analysis

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In complex space-time dynamics, most characteristics of the signal are scale dependent. We are here interested in estimating the horizon of predictability of the variable annual cycle of the vegetation as a fonction of the scale of data aggregation over Sahel.

The NOAA-AVHRR Normalized Difference Vegetation Index (NDVI) data set is the last updated and NOAA-16 calibrated data set (corrected for inter- and intra- sensors drift and for volcanic events). Data are extracted over a Sahel window [lat:12.5 N – 17.5 N; long: 17.5 W – 17.5 E]. For each 8kmx8km pixel, we have a noisy time series of 828 points (3 data/month) from January 1982 to December 2004. Each time series is decomposed into the direct sum of a trend, "seasonalities" and residuals with an ARMA based algorithm. The following analysis then focuses on the annual term (one of the seasonalities).

New NDVI time series are then computed by aggregating the nearby series over different scales: $[8\text{km}]^2$ (no aggregation), $[80\text{km}]^2$, $[800\text{km}]^2$ and $[\sim 8000\text{km}]^2$. For each scale we extract from these time series the invariants characterizing the underlying processes ruling the annual vegetation cycles, say the correlation dimension, Kolmogorov entropy and additive noise level. Horizon of predictability versus scale of the annual vegetation productivity is then deduced from these invariants; The reliability of these results are discussed in particular with regard to the signal to noise ratio, data series length and *a priori* data analysis hypothesis. Some implications are then drawn concerning the possibility to predict the vegetation productivity and likely

impacts of climatic forcings.